Objection to Claim 12

Claim 12 was objected to as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicants cancel claim 12 to overcome this objection

Applicants now request withdrawal of the objection of claim 12.

§112, 2nd Paragraph, Rejection

Claims 6-16 were rejected under 35 U.S.C. §112, 2nd paragraph. Applicants amend claims 6-8 and 15 to overcome this rejection.

Specifically, claim 6 is amended to recite "the caliper body" (in line 6 from the bottom of claim 6) to show that it is the same as that initially claimed in line 1 of claim 6. In claims 7 and 8, the phrase "the thick-walled connection" is amended to "a thick-walled connection". In claim 15, the phrase "disc rotor" (in line 6 from the bottom of the claim) is amended to "the disc rotor" in order to show that it is the same as that claimed in line 4 of claim 15.

In view of the above, Applicants now request withdrawal of the §112, 2nd paragraph, rejection.

Prior Art Rejections

Claims 6, 9 and 12-16 were rejected under 35 U.S.C. 103(a) as being unpatentable over Emmons in view of Takasaki et al. Claims 7, 8, 10 and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Emmons in view of Takasaki et al. as applied to claim 6 above, and further in view of Yamaguchi et al. These rejections are respectfully traversed.

Discussion of Invention

The present invention is directed to a caliper body of vehicular disc brakes using a gravity casting method. Commonly, a vehicular disc brake includes a caliper body having a cylinder disposed on one side of a disc rotor, a reaction pawl disposed on the other side of the disc rotor, and a bridge for coupling the cylinder and the reaction pawl on the outer peripheral

side of the disc rotor. In this arrangement, a braking force can be applied by pressing a pair of frictional pads disposed opposite to each other with a disc rotor held therebetween to contact respective disc surfaces. In general, this type of disc brake is made from iron castings. However, in recent years, a demand has developed for making more lightweight caliper bodies using aluminum or aluminum alloy. These caliper bodies, though, must have sufficient rigidity, which is difficult to obtain with aluminum or aluminum alloy casting. For example, when using a gravity casting method (GDC), it is necessary to direct attention to sink marks and the like of casts to secure sufficient rigidity. In the case of employing aluminum and aluminum alloy, temperature control is severe and unless the casting method is set in consideration of molten metal running efficiency, nonconformity such as sink marks of casts will come to be produced with a decrease in a yield rate as well as productivity. Thus, when the caliper body is made by casting, the selection of the site of providing a sprue becomes an important condition to ensure that a mold is filled up with molten metal to eliminate a sink mark in the cast.

The present invention overcomes the shortcomings of the prior art and thus provides a caliper body without sink marks and the like thereby obtaining a desirable rigidity of the caliper body as well as offering a highly reliable product with a high yield rate. In the present invention, casting of the caliper body is performed by gravity casting methods. In particular, in one embodiment, the caliper body is cast by having a cavity with the side of molding the bottom portion of the cylinder disposed in the upper part of and in the vertical direction of the cavity and with the side of molding the reaction pawl disposed in the lower part of and in the vertical direction thereof. In another embodiment, a union hole is formed at the bottom portion of a cylinder of the caliper body as a sprue for molding the caliper body with a base material. The caliper body is molded with a cavity disposed with the union hole, while the side of molding the bottom portion of the cylinder is disposed in a vertically upper part of the cavity and also the side of molding the reaction pawl is disposed in a vertically lower part of the cavity.

In this manner, a disc brake having a pair of frictional pads disposed opposite to each other with a disc rotor held therebetween is provided. The caliper body includes a cylinder disposed on one side of the disc rotor, a reaction pawl disposed on the other side of the disc

rotor, and a bridge for coupling the cylinder and the reaction pawl at the outer peripheral side of the disc rotor. The caliper body further comprises, in embodiments, a union hole formed at the bottom portion of the cylinder of the caliper body as a sprue for molding the caliper body with a base material.

Rejection of Claims
6, 9 and 12-16

In rejecting a claim under §103(a), three basic criteria must be met.

> First, there must be some suggestion or motivation, either in the references themselves or in knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claimed limitations.

MPEP § 2143.

In rejecting claims 6, 9 and 12-16, the Examiner asserted that it would have been obvious to combine the Emmons and Takasaki references in order to achieve the claimed invention. To support the Examiner's position, the Examiner asserted that Emmons shows all of the features of the disc brake as shown in each independent claim, and that Takasaki et al. teach a gravity casting process of a body having a union hole as a sprue for molding a body with a base material or aluminum alloy. The Examiner further asserted that the Takasaki body is molded with a cavity disposed with the union hole, while the side of molding the bottom portion of a cylinder is disposed in a vertically upper part of the cavity and also the side of molding the other side is disposed in a vertically lower part of the cavity. Applicants do not agree with the Examiner's reasoning and submits that the Examiner has not provided a prima facie case of obviousness.

Applicants agree that Emmons shows many of the features of the caliper body of the claimed invention; however, Applicants submit that Emmons shows an important difference with

the claimed invention which would teach away from using the method of the claimed invention. In Emmons, at col. 2, lines 55 and 56, it is specifically disclosed that

> "[t]he novel truss type caliper structure offers a reduction in both mass and bulk over the traditional types."

Applicants submit by having this novel truss structure which offers a reduction in mass, there would be no motivation to use the molding method of the present invention. That is, the method of the present invention ensures that there is an added thickness (i.e., increase in mass) in the central portion of the caliper body to ensure rigidity of the caliper body; whereas, the truss system of Emmons actually teaches away from an added mass by offering the truss structure which reduces the mass.

As to the Takasaki reference, it is submitted that this reference simply does not show the features of the claimed invention. This is simply because the Takasaki reference is not directed to molding of a caliper body nor any features thereof such as, for example, a reaction pawl, a cylinder or a union hole. But, instead, Takasaki is directed to molding of a wheel. The wheel would certainly not have these features of the claimed invention, especially a union hole used to provide pressure to the cylinder. Specifically, the Takasaki reference does not show:

1. a union hole formed at the bottom portion of the cylinder of the caliper body as a sprue for molding the caliper body with a base material,

2. the caliper body is molded with a cavity disposed with the union hole,

3. the side of molding the bottom portion of the cylinder disposed in a vertically upper part of the cavity, or

4. the side of molding the reaction pawl disposed in a vertically lower part of the cavity.

Instead, the Takasaki reference shows a rotary-mold gravity casting process for molding wheels of a vehicle (col. 2, lines 10-15). In the method disclosed in Takasaki, a casting mold including a

hopper for pouring a molten metal to a runner is provided. A predetermined amount of molten metal is poured into the hopper which is thereafter pivoted with the cast, itself. In this manner, the molten material is poured from the hopper into the cavity in the casting mold. The volume of the molten material in the casting mold can be regulated by adjusting the pivot of the hopper and mold, itself. (See, col. 2 and 3 and Figures 2A-2C.) A wheel is thus molded. However, Takasaki does not teach a caliper body or a specific position or placement of molding of a caliper body, much less a union hole used as a sprue.

Furthermore, the "sprue" taught by Takasaki cannot function as (a flange portion of) a hole through which air of a vehicle wheel is supplied to function for supplying air of a vehicle wheel. In contrast, the union hole of the present invention is directed to a hole (union hole) 24 for supplying an operation oil when the brake system is assembled, as clearly seen in Figures 3 and 4. That is, by machining/processing the sprue, it is possible to provide a flange portion of the union hole as taught by the present invention. (See, 1st paragraph at Page 7.) On the other hand, Takasaki does not teach or suggest that the sprue can form a flange portion of a hole that supplies air to the vehicle brake.

For these reasons, it is submitted the Examiner has failed to prove a prima facie case of obviousness. Simply, there is no suggestion or motivation to modify the reference or to combine the references in order to obtain the claimed invention. This is based on two reasons: (i) Emmons teaches away from increasing a thickness of the caliper body and (ii) Takasaki does not show any of the features of the caliper body to even, remotely, suggest that the Emmons caliper can be molded in the same manner as the claimed invention. With regard to this latter point, it is further submitted that the combination of references does not even teach or suggest all of the claimed features; that is, the Takasaki reference does not even contemplate a union hole used for a sprue, a caliper body positioning with the mold, etc.

Thus it would not have been obvious to one of ordinary skill in the art at the time the invention was made to have

> modified the casting method of Emmons so as to construct the caliper body of Emmons using a casting process in which the union hole 43 is used as a sprue and the side of molding the bottom portion of the cylinder 53 is disposed in a vertically upper part and the side of molding the reaction pawl is in a vertically lower part, in view of the teachings of Takasaki et al., in order to provide an alternate means of fabricating the caliper body as gravity casting of caliper bodies is a well known process in the brake art.

Rejection of Claims
7, 8, 10 and 11

In the rejection of claims 7, 8, 10, and 11, the Examiner asserted that Yamaguchi et al. teach in col. 1 lines 26-29 the relationship between volume and the presence of sink marks in metal casting processes. Applicants, however, submit that Yamaguchi et al. merely has recognized that sink marks may be present in casting molds. There is no teaching or suggestion of specific volume ratios in order to avoid sink marks in a caliper body. Yamaguchi et al. do not even contemplate molding a caliper body. Accordingly, the reasoning of the Examiner that this reference can be used to teach the specific recitations of volume ratios of the claimed invention is simply based on impermissible hindsight reasoning based on the knowledge gained from reading and understanding Applicants' disclosure.

Also, Applicants take exception to the Examiner's remarks that it would have been obvious to use optimal ratio volumes by mere routine experimentation. As shown in the several figures and tables throughout the specification, the determination of the optimal ratios was a complex procedure based on many different variables and was thus more than mere routine experimentation. First, it had to be recognized that there was a problem with gravity casting. Second, it had to be recognized how to solve the problem by using a specific positioning of the mold and caliper body within the mold. Third, it had to be recognized that there are specific rates of solidification of the molten material at different portions of the caliper body. Fourth, it

had to be recognized that there must be a certain flow rate of the molten material during the solidification process in order to ensure that the entire caliper body has sufficient material. Fifth, it had to be recognized that there were specific areas in which there was needed more thickness in the caliper body. Sixth, it had to be recognized that different portions of the caliper body received different volumes of molten material during the casting process. With all of this taken into account, it was more than experimentation that resulted in the specific ratio volumes recited in the claimed invention.

Added Claims

Claims 17-22 are added for the Examiner's consideration. Support for the added claims 17-22 is provided in at least page 14, lines 5-25, page 15, lines 19-25, page 19, lines 15-25 and page 21 of the present specification. Claims 17-22 depend from distinguishable base claim 6 and are thus in condition for allowance.

Claims 17-22 also include allowable subject matter which is not shown in any of the applied prior art references. For example, none of the applied art references, alone or in combination, show or suggestion (i) a sprue disposed in the union hole (claim 17), (ii) the solidification process (claim 22), (iii) forming a flange portion of the union hole by processing the sprue after the casting (claim 19), (iv) placing a core in the mold causing the base material injected from the sprue to run toward the bridge (claim 20), etc.

Conclusion

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicant hereby makes a written conditional petition for extension of time, if required.

Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 23-1951.

Respectfully submitted,

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Marked-Up Copy of Claims

The following is a marked-up copy of amended claims 6-8 and 15.

6. (Amended) A caliper body of a vehicular disc brake to be made by a casting method, said vehicular disc brake having a pair of frictional pads disposed opposite to each other with a disc rotor held therebetween, said caliper body including a cylinder disposed on one side of the disc rotor, a reaction pawl disposed on the other side of the disc rotor, and a bridge for coupling said cylinder and said reaction pawl at the outer peripheral side of the disc rotor, said caliper body comprising:

a union hole formed at the bottom portion of said cylinder of the caliper body as a sprue for molding [a] the caliper body with a base material, wherein the caliper body is molded with a cavity disposed with said union hole, while the side of molding said bottom portion of said cylinder is disposed in a vertically upper part of said cavity and also the side of molding said reaction pawl is disposed in a vertically lower part of said cavity.

7. (Amended) The caliper body of the vehicular disc brake as claimed in claim 6, wherein the side of providing said cylinder is made an action chamber; the side of providing said reaction pawl and said bridge is made a reaction chamber; and [the] a thick-walled connection between said cylinder and said bridge is made a central chamber, and

wherein in the state of cast metal after casting but before being subjected to a cutting process,

the ratio of volume of the central chamber to that of the reaction chamber is in the range of 0.6 to 1.25, and

the ratio of volume of the central chamber to that of the action chamber is in the range of 0.7 to 1.35.

8. (Amended) The caliper body of the vehicular disc brake as claimed in claim 6, wherein the side of providing said cylinder is made an action chamber; the side of providing said reaction pawl and said bridge is made a reaction chamber; and [the] a thick-walled connection between said cylinder and said bridge is made a central chamber, and

wherein in the state of cast metal after casting and subjected to a cutting process,

the ratio of volume of the central chamber to that of the 5 reaction chamber is in the range of 0.6 to 1.25, and

the ratio of volume of the central chamber to that of the action chamber is in the range of 0.7 to 1.35.

15. (Amended) A caliper body of a vehicular disc brake to be made by a casting method, the caliper body being used for the vehicular disc brake wherein a pair of frictional pads disposed opposite to each other with a disc rotor held therebetween, the caliper body having a cylinder disposed on one side of the disc rotor, a reaction pawl disposed on the other side of the disc rotor, and a bridge for coupling said cylinder and said reaction pawl on the outer peripheral side of the disc rotor, wherein the caliper body is cast by a cavity with the side of molding the bottom portion of said cylinder disposed in the upper part of and in the vertical direction of said cavity and with the side of molding said reaction pawl disposed in the lower part of and in the vertical direction thereof.

Marked Up Version of Changes to Specification

Please replace the paragraph spanning pages 12 and 13 with the following paragraph.

Fig. 5 is a diagram explanatory of a process of making the caliper body 10 according to this embodiment of the invention by the gravity casting method using aluminum. This embodiment of the invention is characterized in that the cavity 27 of a mold for use in molding the caliper body 10 is arranged so that the side of molding the bottom portion of the cylinder 20, that is, the union hole 24 is positioned in the vertically upper part of the cavity 27; the side of molding the reaction pawl 30 is in the lower part thereof; and the sprue is disposed in the union hole 24 as the bottom portion of the cylinder 20 whereby to inject the molten metal into the cavity 27. Reference numeral 42 denotes a core. The cylinder 20 is disposed in the substantially center of the bilateral direction and cylindrical with a hollow interior. The one side of the bridge 40 is opened and formed with the cutout on the side of the reaction pawl 30 to cover up these parts, and the disc rotor 12 is clamped under pressure between both friction pads 14 and 14 and this results in producing braking force.